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Paper Abstract

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Paper Title: **Miniature Robotic Vehicle with Hybrid Ground and Air Mobility**

A miniature autonomous robotic vehicle is currently under development which incorporates an array of unique features, including a hybrid ground and air mobility system, a generic imaging sensor platform, a modular payload capability and a robust autonomous guidance and navigation system.

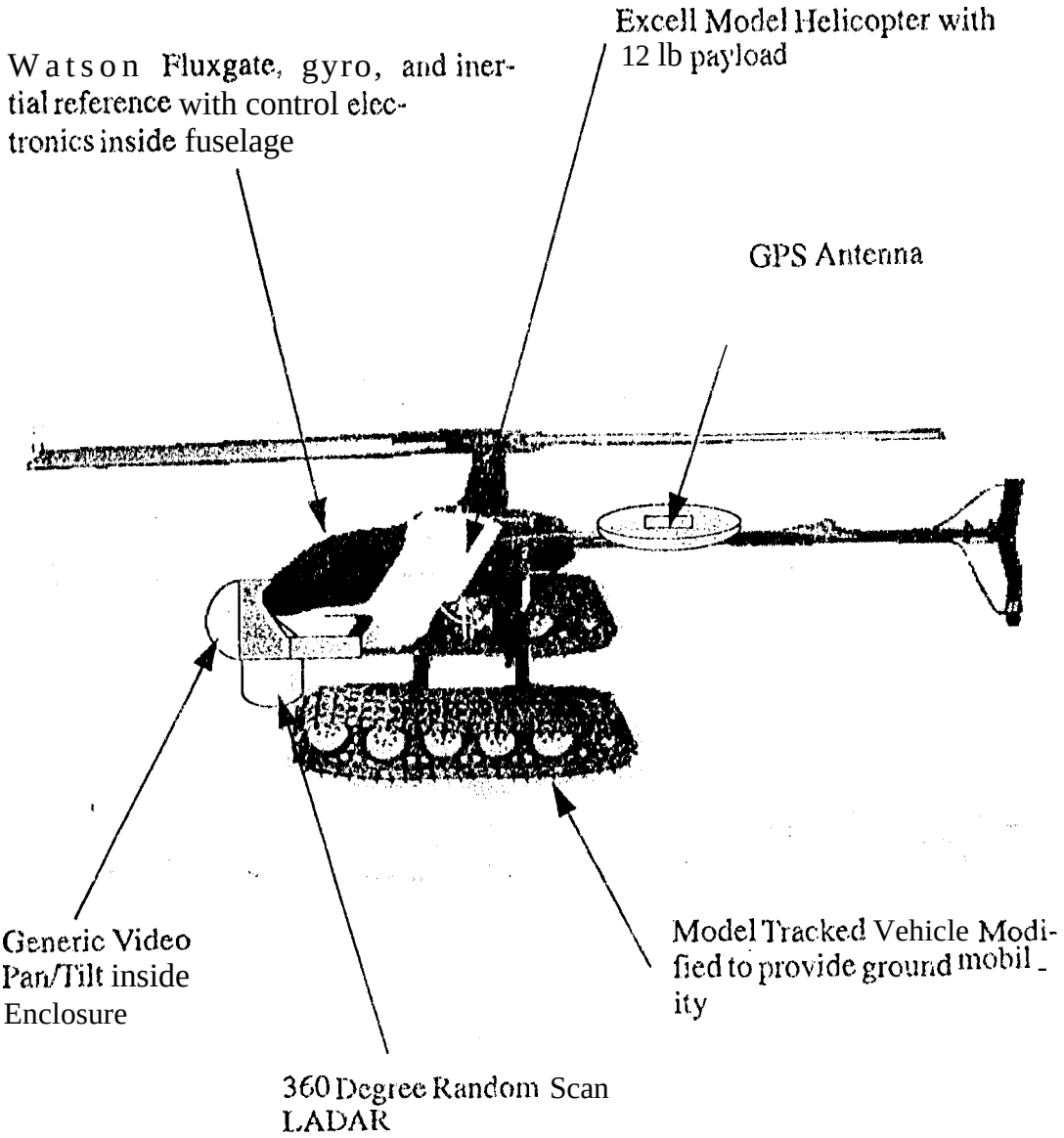
The hybrid ground and air mobility system incorporates a miniature dual remote controlled flyer for flexible air mobility and a rover capability for ground based locomotion. The rover vehicle can be detached from the free flyer airframe and lowered on a remote controlled tether to allow close proximity ground sensing, surveillance, imaging and sample return of contaminated soil samples or plant specimens from open cannabis farms for post mission analysis. This dual mobility design approach places a premium on micro-devices such as sensors, control electronics, power supply components and communication subsystems to assure that the free flyer and the rover can perform satisfactory and have an acceptable mission range.

The imaging sensor platform combines a laser radar (LADAR) and a random access scanning mechanism, with a video-camera sensor on a pan/tilt mechanism to allow random access directed video imaging. The LADAR serves a dual role, as an obstacle detection sensor for autonomous

navigation, or optionally as a ground mapping or object contour mapping payload sensor. Various other video *sources* as possible, including CCD cameras, image intensified video cameras, and infra-red (FLIR) video cameras, depending on the desired mission application.

The robust autonomous navigation system combines sensor's and control strategies for both air and ground autonomous vehicle operations. The primary elements of the design include a position estimation and mapping subsystem, and a mission manager subsystem. The miniaturized robotic vehicle includes recent advances in high accuracy small GPS sensor, low cost inertial guidance, and a directed LADAR to enable a compact and low cost effective robotic system. The autonomous vehicle software architecture has been developed and tested.

The system design will be discussed with trade studies options that have been considered. A summary of the performance, weight, size, price considerations and lesson learned will be presented


Excell Model Helicopter with 12 lb payload
Watson Fluxgate, gyro, and inertial reference with control electronics inside fuselage
GPS Antenna
Generic Video Pan/Tilt inside Enclosure
Model Tracked Vehicle Modified to provide ground mobility
360 Degree Random Scan LADAR